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VOL. XIV, No. 6 NOVEMBER-DECEMBER, 1953

BORDEN'S REVIEW

of

NUTRITION RESEARCH

NUTRITION AND MATERNAL HEALTH

BORDEN'S REVIEW
of
NUTRITION RESEARCH

Reviews and summaries of research information concerning nutrition and foods. Published bi-monthly by THE BORDEN COMPANY; officers of the Company: Theodore G. Montague, president; E. L. Noetzel, treasurer; D. T. Orton, secretary. Editorial office: 350 Madison Avenue, New York 17, N. Y.

NUTRITION AND MATERNAL HEALTH

By ICIE G. MACY, Ph.D., Sc.D. **(see page 94)**

". . . defense of mothers is the defense of nations."
— MOTHER'S CHARTER

Nutritional and physiologic state of the body is the result of a chain of past experiences involving food intake, the processes of their utilization, the physiology of the body functions, physical environment; attitudes and social conditions. The prerequisite to a healthy, buoyant and resilient life is provision of a food supply furnishing all the nutrients necessary for structural and functional activities in an environment permitting full utilization of them. Pregnancy and lactation increase maternal requirements for protein, minerals and other materials with which to build and service fetal and placental tissues; to condition or recondition the body tissues for the demands of maternity at the time of labor and subsequently, during puerperium and lactation.

It is important therefore, to have sufficient intakes of all food factors in pregnancy to provide generously for the growing fetus; for the building up of the maternal body, especially should it be undernourished at the time of conception; for the hypertrophy of the maternal organs and tissues; and to assure sufficient storage to meet the needs of parturition and provide adequately for lactation (1). In studies of the effect of controlled diets during pregnancy, a relationship has been shown between the prenatal diet of the mother and the development of rickets in the infant. When mineral and vitamin intakes are low and mineral metabolism is defective during pregnancy, the result not only is a predisposition to bone and tooth defects in the intrauterine parasite, but evidence also indicates that in some cases the associated nutritional disturbances in the mother may be one of the etiologic factors in vomiting, eclampsia, osteomalacia, dental caries, tetany and premature labor. An over-strain on the function of hematogenesis during pregnancy is shown by the mild secondary anemia which is common and in some instances becomes severe. The blood requirements of the fetus, the increased maternal blood volume, the blood loss during parturition, and other factors in this anemia contribute to the metabolic over-load. Newborn infants from mothers with hypochromatic anemia show a normal blood picture but develop anemia during the first year of life. If iron is given to the mother during pregnancy, or to the infant, this anemia is averted. Unless the supply of iron in the mother's body is adequate the fetus of an iron-deficient mother does not accumulate enough of this essential blood component to carry it through infancy.

The progressive gains in the maternal body weight are only a gross measurement of the storage of nutrients, because this as well as other types of growth are known to vary in chemical composition, and accumulation of body weight is not a direct measure of storage of tissue-building constituents. Nonetheless, weight gain is important in relation to pregravid weight; to rate of loss or gain in the first and second trimesters; to total gain during gestation; and to gain or loss subsequent to delivery, in the puerperium, and during lactation. Excessive weight gains or losses increase the susceptibility of the mother to disease and the health hazards of the infant during its first year of life.

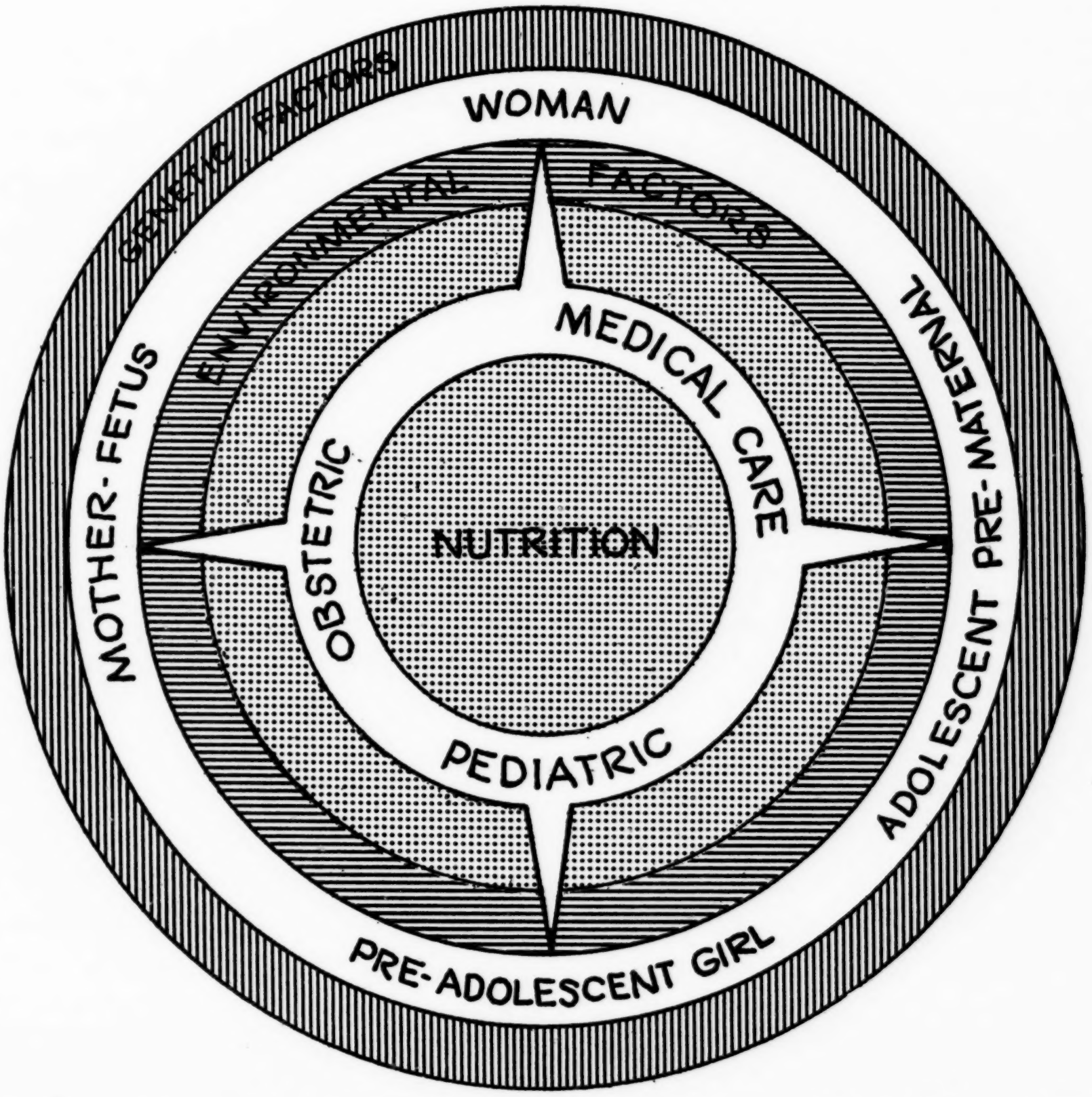
Animal studies using highly controlled procedures show that early in pregnancy, nutritional deficiencies of the mother may result in retardation of the growth impulse in the fetus and in fetal structures (1). Various types of avitaminosis are followed by interruption of the regularity of the oestrus cycle. At an early state of development, frustration of the growth impulse in the fetus may have as consequences wide-spread degeneration of the skeletal, soft-tissue and nervous systems culminating in deformities, loss of sight, hearing and smell; even life itself may be thwarted by resorption of the fetus. Such extreme deficiencies are not seen frequently in human beings, but the results of animal experiments do accentuate the importance of adequate maternal storage for the development of the fetus. The conditions encountered in human mothers who bear malformed infants frequently are so similar to those found in animals with deficiencies early in gestation that similar origins seem highly probable. Controlled observations of animals have stimulated great interest in attempts to correlate the findings with human experiences and sound a note of warning that regardless of the causes of depletion —poor diet, starvation, defective absorption, infection or other debilitating processes—the losses should be replaced prior to pregnancy. At the time a pregnant woman seeks medical advice, fetal damage may already have occurred if her previous diet, utilization, or general health have been poor.

A recent summary of the literature emphasizes an intimate interrelationship between nutritional status of mothers before and during pregnancy and the health of the children they bear (1). Insufficient food consumption or an unbalanced food intake may initiate faulty metabolism later reflected by a general debilitated state of either the mother or the child, or both (2-8). Coordinated clinical, biochemical and dietary observations have demonstrated that prenatal preparation for motherhood, with nutritional conditioning or reconditioning prior to conception and during pregnancy, are worthy of wide-spread practice. Eating the right kinds and amounts of food is reflected in better maternal health during gestation; in less trauma from the stress of labor and delivery, and speedier recovery; and in better preparation for nurs-

ing the infant during the period of greatest physiologic readjustment and maximum growth and fundamental emotional stabilization.

Infant growth studies have emphasized the importance of the right kind of food during the formative period and the fact that the infant at birth is nutritionally nine months old is proof sufficient that special consideration should be given to the diet of the mother during gestation. The interinvolvement of the reciprocal relationships that exist between fetus, child, adolescent girl and mother are schematically demonstrated in Fig. 1. A woman at the reproductive period in life has been influenced by heredity and all en-

FIGURE 1



Reciprocal human welfare relationships between fetus, child adolescent girl and woman as influenced by food and nutrition and medical care.

vironmental influences, such as excesses and deficiencies of dietary intake and injury or disease occurring in each preceding epoch of life. The effects of experiences in any epoch of the life cycle are carried over into another and thereby modify biochemical individuality and alter metabolic requirements during succeeding stages of growth and maturity.

Medical care is a major factor in the life experience of woman especially, and physicians, with nutritionists and educators, are a major force in the promotion of good nutritional practices among healthy as well as ill individuals. Medical care also includes nutritional support during illness and recovery, particularly during the crucial periods in life when medical supervision is integrated with obstetric and pediatric practice.

The reciprocity between fetus, mother and child is given new significance by a recent report from the Metropolitan Life Insurance Company (9) which points out that while the teens are the healthiest years of life with illness at a minimum, "the recent tendency toward early marriage and parenthood has brought the health problems of family life to an increasing proportion of teen-age girls. About one-third of our brides and about one-fourth of the mothers bearing a first child are less than 20 years old. Almost 6% of the deaths among 18-and 19-year-old girls in the insurance experience were due to pregnancy and childbirth. The record shows clearly that most of the immediate threats from disease to the lives of teen-agers have been removed. Nevertheless, a number of important health problems still remain. Relatively, the problems of mental and emotional adjustment of teen-agers loom larger than ever before. Many difficulties arise because of the complex and rapid changes that occur in this period of life. During these years, special attention must be given to health habits. A high proportion of teen-agers have poor teeth and defective vision, with need for remedial measures for both conditions. Many youngsters, particularly girls, show the effects of poor dietary habits." The fact that pregnancy in young girls may be superimposed upon a continually growing maternal body already hampered by effects of past and current dietary inadequacy should be of concern to every person interested in human welfare.

Timing Factor

Because of its far-reaching effects upon health and welfare, early nutritional preparation of young women for the responsibilities of motherhood needs to be emphasized. Many nutritional deficiencies that play important roles in pregnancy may be greatly exaggerated when they are precipitated by the stresses incurred soon after conception. At that time, the woman may not know that she is to become a mother, which emphasizes the importance of continually encouraging young people to maintain for themselves and their

children the best possible state of physical health. In these objectives, the combined efforts of all concerned with human welfare—physicians, nutritionists, dietitians, public health workers and others—cannot be too great.

Reports of various congenital defects in infants born of mothers who contracted rubella in the early part of pregnancy (1) point to the susceptibility of the fetus to dire influences in its initial two months of life, and accentuate the importance of the time factor. Rubella in mothers during the first two months of pregnancy will produce defects in all of the infants while rubella during the first three months cause defective children in one-half of the offspring. At these stages of gestation, many mothers have not yet sought medical advice.

Unfortunately, too little knowledge of human beings exists with respect to specific maternal nutritional deficiencies and inadequate nutritive reserves and their influence upon the health of the fetus throughout life. It has been demonstrated in animals that deficiency of vitamin A, of riboflavin, of cystine and of folic acid occurring at the time of conception or within a brief period immediately following, also may lead to malformations, restricted growth, impaired nutritional stability and therefore, to impaired health of the fetus. Recent evidence indicates that an excessive intake of some of these food factors or an excess of one which destroys the balanced intake of several may also be injurious. If a cue can be taken from experimental investigations with animals and the effect of rubella during human pregnancy, the timing factor with respect to the prevention of untoward deficiencies and infection is extremely important to each succeeding generation.

Tompkins (10) pointed out that the patient, definitely underweight, who becomes pregnant and who fails to gain during the first trimester is invariably the more difficult patient to control and constitutes the greatest hazard in pregnancy. He stated: "The pattern of gain in weight during the first two trimesters is critical in that the probability of such a catastrophe rises sharply for those patients who are underweight at the beginning of pregnancy, or who fail to gain acceptably during the first two trimesters . . . Excessive gains in weight during the second trimester definitely increase the probability of preeclampsia, especially should this excessive gain be continued through the third trimester. Thus, the first two trimesters set the pattern for premature labor, and the second and third trimesters establish the pattern for preeclampsia. The balance is delicate and for maximum protection, rigid control of the rate of gain must be maintained." Dieckmann emphasized that "every pregnant woman should desirably be given careful diet instruction either by a doctor or by a nutritionist working in conjunction with the doctor. Periodic observations should be made of the patient's diet during pregnancy (not

after delivery, when it is too late for corrective measures) to be certain that she is following instructions."

The baby girl of today is the mother of tomorrow. Prolonged dietary inadequacy may force the body to adjust itself to lowered nutritional performance with reduced vitality whether the inadequacy occurs during fetal life; childhood, especially adolescence; or maturity. With persistent marginal or sub-marginal diet, or sub-optimal health, the body is faced not only with enlarged nutritional requirements but also with repleting former reserves. Because the nutritional state of the body at the time of conception may be so variable, securing dietary history and nutritive background becomes an important feature of the clinical record during pregnancy, since the guidance of mothers is most effective on individual bases.

Investigations demonstrate also that the well-fed individual is more apt to pass through the reproductive period in better health and with fewer complications (8, 11, 12). A close relationship exists between adequate intakes of protein and outcome of pregnancy for both mother and newborn infant (12, 13). There is apparently a very fine line between how much or how little a woman should gain in pregnancy to take care of the combined weight of fetus, placenta, amniotic fluid, term uterus and breast, and increase in blood volume (14). Dieckmann (15) estimated the total gain necessary in pregnancy to be not more than 6.7 kg., the combined weight of fetus, placenta, amniotic fluid, term uterus and breast, and increase in blood volume. His studies led him to conclude (14) that excess of weight gains above 8 kilograms over the ideal weight lead to increased incidence of preeclampsia and increase the possibility of hypertension, of menstrual disturbances associated with obesity and of other complications that go with obesity.

Progress made during the last half-century in lowering maternal and infant mortality rates in the United States has been due in large measure to improved prematernal care, prenatal care and obstetrical technique and to the development of new antibiotic therapy. Approximately a quarter of the maternal deaths are due to toxemia and associated conditions which may in part be traced to malnutrition or under-nutrition prior to or concurrent with gestation. During the same period, infant mortality during the first year of life has been similarly reduced; however, less satisfactory progress has been made with deaths during the first month of life. Of the infant deaths, two-thirds are attributable to prenatal and natal causes, of which premature birth and congenital malformation predominate (1).

When the Committee on Dietary Allowances of the Food and Nutrition Board, National Research Council, formulated the Recommended Dietary Allowances for pregnancy, the members considered various types of records that were alleged to indicate needs during the stress of childbearing. The

group was handicapped because, among the few studies undertaken with women in the different stages of reproduction, too few included representative subjects observed throughout the process of pregnancy, labor, parturition, and lactation, with study of the health of their respective babies; also the reports included too few constituents of diet and blood in comparison to the large number of nutrients known to be essential for healthy life. Direct evidence obtained from metabolic balance studies and indirect evidence for blood levels, urinary excretion, fetal analyses and dietary studies formed the basis of the judgment recorded in the Recommended Dietary Allowances. Since so little is known regarding the endogenous reorganization and physiologic adjustments of the mother during the early months subsequent to conception, owing to placental and fetal growth, dietary allowances were recommended only for the last half of pregnancy. The recommended allowances have merit; have served as a valuable guide; and have stimulated interest in obtaining more specific information concerning the food women eat and its effects.

Methods of Studying Requirements

Various methodologies have been applied in attempts to evaluate the physiologic adaptation of individual women and groups of women to the increased nutritional requirements of reproduction (1, 16, 17). In early years, some insight into the metabolism of mother and fetus was gained by chemical analyses of fetuses at various stages of development which came to autopsy because of some accident, abnormal condition of the mother, developmental defect, or physiologic dysfunction of the fetus. In early metabolic studies only the nutritional factors known at that time were investigated. Balance studies include analyses of food eaten over a given period of time, and of urine and feces excreted. The differences between the food eaten and excretion is presumed to represent the amounts of nutriments assimilated by the mother for increase in blood volume, the growth of the uterus, the development of the mammary glands and placenta, the formation of amniotic fluid and providing the needs of the developing fetus. In recent years anatomic, physiologic, dietary and clinical studies also have been used to evaluate the processes occurring during pregnancy.

Dietary Evaluation

In the past three decades, studies of human beings have included determinations of nutrient intake and utilization under different physiological, emotional, economic, and environmental conditions. Clarification has been sought of the relative merits of the different dietary study methods in vogue

and of conditions under which each can be reliably and practically applied for the purpose of extending knowledge relative to the influence of food upon health (18). The necessity for more standardization in experimental procedure and for quicker and more precise methods of evaluating results arises from the vastly accelerated tempo of research, from difficulty in comparing results in the literature and from the need for more rapid transition of experimental knowledge into medical application.

No technical method, no matter how good, can be applied in all circumstances. Dietary methods are no exception. The choice of methods depends upon the kinds of problems involved and the objectives of the investigation (19). In any event, specific problems to be undertaken always require adjustment of techniques to the practicalities of the study situation. The quantitative collection and analyses of diets is time-consuming, extremely costly and limits the number of subjects studied and the duration of a study. Qualitative methods of dietary evaluation have been developed (20) in response to the necessity for simplification of methodology (21). Although many kinds of errors are inherent in both quantitative and qualitative evaluations, when properly used and interpreted both methods are valuable for obtaining basic information regarding the diets of individuals and population groups.

Evaluation of nutrient intake is basic to the science of nutrition and furnishes useful and valuable data on the problems of nutrition in relation to health. Alone however, it does not determine the nutritional status of an individual because current and previous environmental factors may affect nutritive state. It is generally agreed that there are few short-cuts possible in the quantitative collection of the food intake, sampling, weighing, and analyzing in the most accurate manner; in meticulous calculating and recording of the results; and, in proper evaluation of the data in terms of subjective factors involving the experimenter and the subjects studied.

To correlate individual dietary intakes with biochemical and physiologic findings for individuals, such as blood levels, direct analyses of food are necessary for precision consistent with the problem. On the other hand, some physiologic studies may not require this exactness and the expenditure would be wasteful. Especially in determining dietary intakes of large groups of individuals, it is necessary to use standard food composition tables because the project does not warrant the time, technical facilities and financial resources for detailed chemical analyses. Since calculated values are based on analytical values, special tables should be developed for local use and checked against analyses of diets obtained in the environment, and further, against laboratory determinations for subjects eating the dietaries. When, through

necessity, calculations have been substituted for analytical procedures, the values obtained contribute more if the reliability of the calculated diet is recorded.

Shortened methods for qualitative dietary evaluation have been developed and tested for reliability; however, the mechanics of handling the data and computations by these methods still entail considerable time. The time required by the usual method of calculating nutritive value by computing each food separately was shortened by about 40% by the presentation (21) of a table in which foods similar in composition were given an average value. The procedure is justified on two primary counts: first, experiments demonstrate no significant differences between values obtained by the two methods; and second, individual quantities of food vary widely in composition owing to variables in production, handling, preparation and preservation.

The discrepancy between the values obtained with individual food composition tables and the shortened form is least when the diet is varied in composition and includes a record of several days. With liberal diets composed of numerous foods there is a tendency for a week's consumption to approximate the calculated averages, but for low income groups and in some communities where particular diet patterns are dominant, the shortened method of evaluating would need adaptation. For individuals whose diets are least varied, the true intakes may be masked by determination on the basis of an average mixed diet, especially with respect to some of the vitamins. For the short table to be accurate, recognition of differences in the frequency of use of the foods make it necessary for different localities to adapt the table to food habits of the region.

Although the short-cut method tends to level out some differences between individual intakes, it is a useful procedure. The errors introduced by this method probably are unimportant, since calculated nutritive values, regardless of methods used only enable the classification of very broad groups of individuals. On the basis of qualitative estimates of diets, individuals in a study can be classified in broad groups and these groups compared with respect to blood values and other evidence of nutritional conditions. The use to be made of individual diet records should determine the best method of estimating nutrients. It is impossible to determine the total error in such values, though we know it to be large, and greater confidence in simplified methods than procedure warrants should be avoided.

Dietary histories and dietary records properly cross-checked furnish useful and valuable data when taken by a skilled interviewer with balanced judgment and the interest, confidence and cooperation of the patient is secured (20). The diet history assists in interpreting the nutritional findings for an individual, and the diet record affords valuable information in iden-

tifying possible deficiencies in a diet and in instructing the person in ways to improve his eating habits. The values calculated for these purposes need not be precise and should not be assigned an accuracy which is not justified. The most accurate diet values possible to obtain are desirable for extending knowledge of the basic principles of the science of nutrition. We need more satisfactory methods of analysis, and to apply them skillfully, and to determine which and how much of the different nutrients are essential.

One of the greatest challenges in human biology is to find methods of evaluation that will measure progress attained in logical sequence from the beginning to completion of the body structure, upon which are superimposed its vital functions. There is need for indices of the status of the body tissues and, in case of pathologic disturbance within the organism, they may reflect alteration in the fluid matrix.

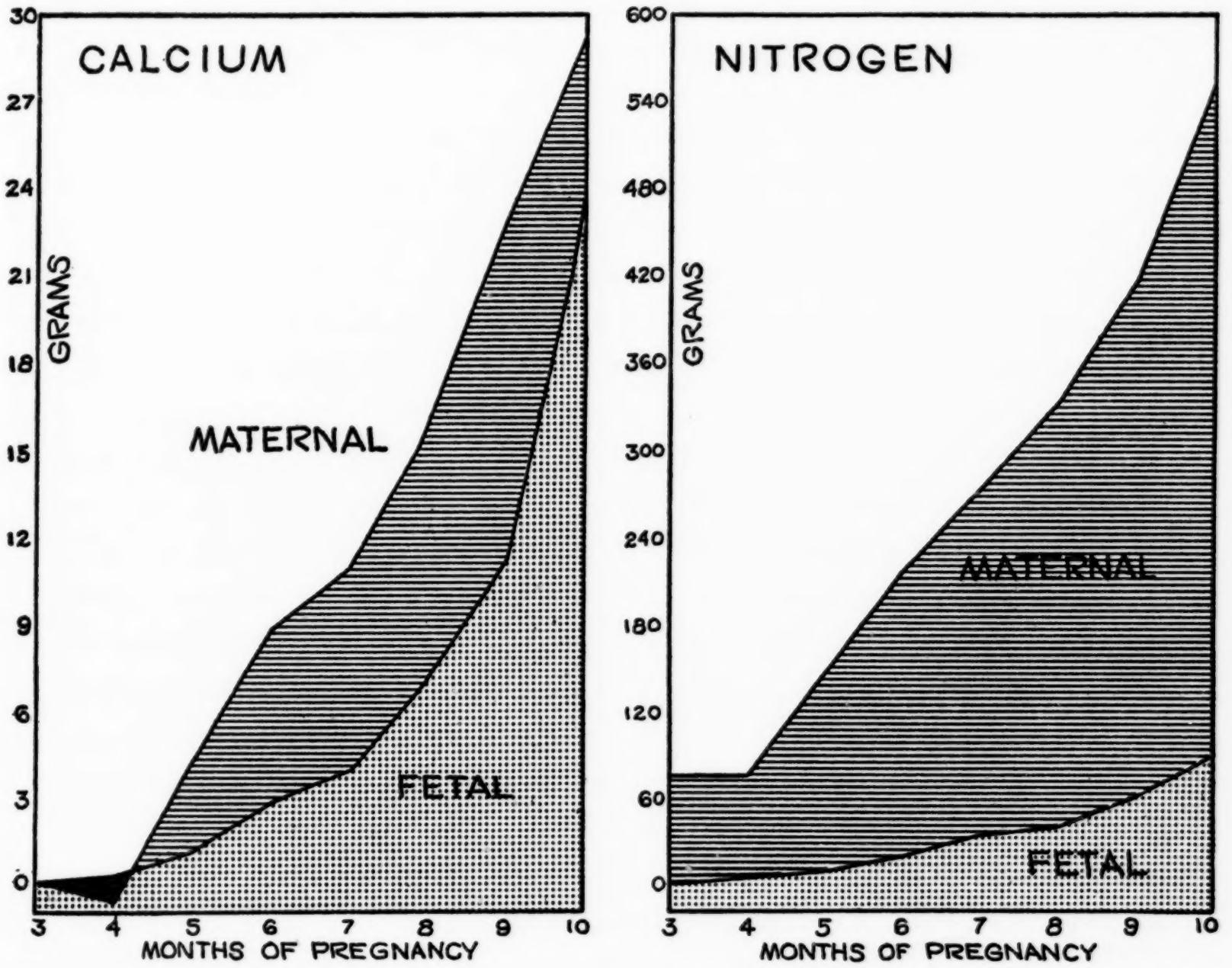
At the inception of disturbed physiological or pathological states, the regulatory mechanisms are thrown out of balance. The results are observable either in the levels or distribution of blood components; in the level or distribution of urinary components; in the retention of nutrients from the food intake; and in change in composition or structure of the blood cells and of their function. Fluctuations in magnitude which take place in the maternal body during pregnancy may be regarded as essential to the physiologic process since any fixity of function or process, or of structure, might interfere with desirable growth and maintenance of the fetus. The maternal organs must continue to function and, simultaneously, while the fetus grows and develops, to prepare the body for future care of the baby after birth.

A consideration of continuous nitrogen and mineral utilization during pregnancy, parturition, puerperium and lactation demonstrated without a doubt that the nutritive state prior to conception affects the metabolism during pregnancy, labor, and delivery, and subsequently, the ability to produce milk (3, 22, 23). Fundamental information on the metabolism of women has been obtained and reviewed recently (1).

The metabolic balance gives the comparative rates of gain of the nutriments and their relation to one another as the body adapts itself to the increased needs of pregnancy, to the nutritive loss and trauma at parturition, and to the net loss or gain during puerperium and lactation. Although the method does not differentiate maternal, fetal or placental *utilization* of the retained nutrients, nor the distribution of them to target organs in the two organisms, a rough approximation can be made by calculating progressive fetal needs from chemical composition of fetal specimens obtained at autopsy. Generally, the maternal body deposits a large excess of nutrients over and beyond that needed for the fetus and placenta. For calcium and nitrogen

Fig. 2 illustrates the great excess of maternal storage over the requirements of the fetus. This excess is much greater for nitrogen, which is involved in construction of the soft tissues and in preparation for the losses and physiologic changes incident to parturition.

FIGURE 2



Maternal and fetal storage of nitrogen and calcium from the third to the tenth months of pregnancy. Adapted from Macy, et al. (2) Am. J. Obstet. Gynecol. 27, 878, 1934.

Metabolic studies are of great value in increasing knowledge of the nutritional status of women as it may be affected by a variety of conditions; however, because of the great outlay of equipment, resources and expense involved and the difficulties encountered in keeping mothers under controlled conditions and yet permit them to live normal lives, the number of subjects who can be studied is greatly restricted in relation to the importance of the problem and the many environmental, emotional and socioeconomic factors involved. It will be necessary to rely upon simpler techniques to aid in extending the knowledge of nutritional status on mass populations.

Biochemical assessment of nutritional status of women during puer-

perium and lactation (24) with respect to thiamine, riboflavin, vitamin A, vitamin C, niacin, pantothenic acid and biotin have demonstrated some unique physiologic characteristics and a need for further study in this area. The blood, which services all tissues of the body, lends itself to observation of many types of chemicophysiological changes accompanied by pathological transformations. Blood, with its many components, is used as a medium for the study of health and disease, and the magnitude of variability of many constituents in different physiologic states and pathologic transformations. Singly or in combination, values of different blood components may give a measure of the ability to the organism to maintain normal function in the face of changing structure, function and environment whether during health or disease. With combined observations focusing upon the blood fluid, ample evidence has been presented that this tissue offers a fruitful field for exploration of physiologic and pathologic transformation of the human body in various epochs of life. In an investigation of the physiologic changes in plasma proteins characteristic of human reproduction, electrophoretic data for women during and following uncomplicated and complicated pregnancies demonstrated the variations attributable to individual physiologic differences among women, and at the time in the cycle during which the blood samples were drawn (16). Observations of levels of total serum protein, albumin, and alpha$_1$, alpha$_2$, beta, phi and gamma globulins during pregnancy and following delivery and postpartum demonstrated a characteristic pattern of distribution of these components for uncomplicated pregnancy which is disturbed in complicated pregnancy, some diseases having distinctive patterns (25). Changes in the pattern of the plasma proteins may also be induced by the stress of surgery (26).

In evaluating the nutritional states of large groups of mothers during pregnancy and their respective newborn babies, methods combining determinations of blood concentration levels (hemoglobin, total protein, vitamin C, vitamin A, carotene, thiamine, riboflavin and alkaline phosphatase by macro—and microchemical determinations) with dietary intake and clinical examinations are being used (17, 27, 28). While several working groups (29) are pooling their efforts in developing more standardized methods of evaluating the nutritional status of mothers, Darby (27) has emphasized, in considering biochemical measurements:

> Interpretation of biochemical data will remain insecure until many of these metabolic influences are clarified. The present state of knowledge of the biochemical assessment of nutritional level during pregnancy and lactation is *one of investigation, not of interpretation* of observed change.

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ABOUT THE AUTHOR

Borden's Review of Nutrition Research takes particular pride and considers itself privileged to present this paper by Dr. Icie G. Macy, not only for the content of the paper, but because it provides us with the opportunity to recognize a lifetime of endeavor in behalf of the nutritional welfare of children. The immensity of the task carried out by Dr. Icie G. Macy and her associates of The Children's Fund of Michigan is best and most completely described in the several volumes on Nutrition and Chemical Growth of Children published by the Charles C. Thomas Co., Springfield, Illinois. These writings record the accumulated experience of the group directed by Dr. Icie G. Macy over a period of nearly a quarter of a century. The contributions made have most adequately given substance to the purpose of the Children's Fund of Michigan which is "To Promote the Health, Welfare, Happiness and Development of the Children of the State of Michigan, Primarily, and Elsewhere in the World."

Something of the philosophy of the author in her life work is perhaps best shown in her own words—"For more than twenty years we have delved for knowledge of the processes by which the human body enlarges itself and maintains life. — In our attempts to expand scientific knowledge of life processes we have not hesitated to

enlist the knowledge and methods of other sciences and we have sought the assistance of those especially qualified in particular phases of the investigations. We have been firm in the belief that a single approach to such broad problems may be productive of misinterpretations. Although the processes of nutrition and growth involve chemical reactions which result in the incorporation of new tissue into the body, either as addition or replacement, chemistry alone cannot provide complete information. Thorough understanding must include evaluation of the many influences which may predetermine, alter, or control the efficiency of the processes themselves. For this reason we have emphasizd the value of making numerous types of determinations and a variety of observations."

Dr. Icie G. Macy received her Ph.D. degree from Yale University under the tutelage of the great teacher Lafayette B. Mendell and has carried on her work in the best traditions of the Yale Laboratory of Physiological Chemistry. Her endeavors have been recognized in the form of an honorary Sc.D. degree from Wayne University, and such awards of distinction as the Borden Award, the Norlin Achievement Award, and the Francis P. Garvin Medal.

Again we say we are proud to present Dr. Icie G. Macy to our readers.

— THE EDITOR

Borden's Nutrition Reviews in Preview

Although it has been the custom for *Borden's Review of Nutrition Research* to present in the December issue a review of the year's highlights in Nutrition Research, this type of abbreviated report will be abandoned in favor of a *preview* of topics for *future* presentation. In effect this will present certain of the high spots of the past—since the important current and past developments must guide us in establishing the pattern for the future.

You, the reader, at this point might well ask, "How are topics selected for *Borden's Review of Nutrition Research?*" Selections are made, after conference and discussion, by the members of the editorial board and the editor, who are guided in their choice by those events or current trends in research that have either advanced our knowledge of the fundamental principles of experimental nutrition and biochemistry, or have provided the basis for new concepts or applications in the wide scope of nutrition. It is obvious that in any year only a limited area can be presented. We can only hope that the topics previewed below will stimulate and hold your interest in *Borden's Review of Nutrition Research.*

Since the beginning, man has exhibited much more than a casual interest in his food, often with the idea that it could influence his well-being. Certain foods were considered to have special attributes that endowed the consumer with unusual strength, courage or mental acuity. As society developed and our knowledge of foods expanded, people became increasingly interested in the division of foods into the component parts of carbohydrate, protein, fat, ash, and roughage. Since the turn of the century, vitamins have been added to the list and the intense activity in the area of vitamin research has resulted in our knowledge of some 16 substances that are called vitamins. Despite this industry in vitamin research, nutritionists are returning with ever increasing interest in a more careful examination and study of the basic components of the diet (i.e.) carbohydrate, protein, fat, and mineral.

In line with these developments, the

role of fat and fatty acids in nutrition will be presented in an early issue of the *Review*. This subject is particularly timely since lipid metabolism seems to be involved in certain of the so-called degenerative diseases (i.e.) atherosclerosis and diabetes. The inter-relationships of cholesterol, phospholipid, macromolecules of lipo-protein are all curiously interwoven in the background fabric of these diseases. Since obesity and overweight loom as a major medical hazard and have led to such slogans as "the longer the belt line the shorter the life line"—we have further need to evaluate the role of fat and fatty acids in nutrition.

Despite the increased interest in such nutritional factors as fat, vitamins will not be sidetracked, since a review will be presented concerning pantothenic acid in nutrition. Although this vitamin has long been recognized as a growth factor essential for many animals and microorganisms, recent work has elucidated its significance as a part of coenzyme A which provides a central and crucial switch in the network maze of metabolism. Also, the interrelationships of pantothenic acid and adrenal function give us a new insight into the related roles of hormones and vitamins in biological activity.

From the detailed intricacies of metabolism we will turn our attention to the role of applied nutrition in a troubled world — nutrition on the international scale. From nutritional abundance and obesity we will focus our attention on nutritional scarcity and starvation. Is it possible that the line of least resistance to communism is the caloric level of the basal metabolism? When does food become more important than political ideology? A frank and thorough analysis of problems confronting nutritional adequacy on a world wide scale will, we hope, interest every reader.

From nutrition on this earth, we will expand our attention to a fascinating problem that involves the universe—the process from which we derive not only the food we eat, but the energy we use—photosynthesis. Without the utilization of the sun's energy in photosynthesis all of this earth would soon be a cold, dead place. Photosynthesis and its relation to nutrition will be a future topic for presentation in this review.

Although the sun performs the marvelous act of photosynthesis it seems so routine that it is not generally as much appreciated as performance of another kind — that is, personal performance. Since most of us find it necessary to work and since our work efforts are for the most part rewarded on the basis of our ability to perform, we will in the future review the literature on the influence of nutrition on work performance. How do different kinds of work affect nutritional requirements, and how can meals be best divided and presented to give a worker not only adequate food but give him maximum efficiency and well-being? This fascinating topic we are sure will provide you with new and informative ideas.

Although most nutritionists strive to keep people well, an important and complicated aspect of this subject is Diet Therapy and Disease. A review will be presented which will attempt to bring up to date the newest concepts and ideas concerning the role of nutrition in such disease entities as tuberculosis, cancer, rehabilitation and non-oral feeding.

In closing this preview of reviews, we, the editorial board and the editor wish to extend our gratitude to you the reader, for your patience because of the late arrival of some of our issues, and for your gracious acceptance of some of our selections which may not have been of prime interest to you. This, you will understand, is due to the wide and varied nature of our audience.

THE EDITOR